Volume 36 January, 1950 *Number 1*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

ELECTRIC MOTOR LUBRICATION

PUBLISHED BY
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LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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ELECTRIC MOTOR LUBRICATION

MOTOR BUILDERS have done a remarkable job in perfecting the design of a machine which operates probably under more severe conditions, more frequently, than any other piece of machinery. It was not too long ago that use of electric motor power in some types of service was approached cautiously, i.e., where arcing might cause explosions, or where the motor might have to run deluged with water. The explosion-proof motor changed all this. Today engineers take a practical view of maintenance as related to their motor power. They regard motor lubrication in a similar manner, fully realizing that dependable lubrication has a definite relation to motor life.

Speed a Factor

The service dictates the application and the type of motor that should be used. The high speed type of motor is adaptable to machine tools, woodworking equipment, shoe machinery, airplane beacon drives, and vacuum cleaning machinery, etc. Splash-proof and explosion-proof motors, in turn, find an extensive field of application in dairy, meat packing, grain elevator, cement mill, brewery, stone cutting, and laundry service, wherever leakage of lubricant would be objectionable.

Windage is increased by high speed. Windage can cause abrasive dust to be pulled through both the bearings and ventilating apertures. High shaft speed also places a severe load upon the lubricant in its protection of the bearings if high temperatures may prevail.

TO lubricate an electric motor effectively it is necessary to know about the bearings, how they are installed and what provision has been made for their lubrication. In other words, electric motor lubrication means bearing lubrication, except where the gear reduction motor is involved. Then, sometimes, the bearing lubricant on the gear end also must lubricate the gears.

In electric motor design ball bearings, roller bearings or sleeve-type bearings are used. The type used depends upon the application of the motor, i.e., the type of machine to be driven, how power is transmitted from motor to machine, shock and noise limitations, position, exposure to water or dust, accessibility for servicing, etc.

Motors are probably more widely used than any other type of machinery,—wherever electric power is to be converted into mechanical energy, motors must be used. As they may be run in any position, under sub-zero to oven temperatures, at speeds from a few hundred up to several thousand r.p.m. their bearings require the most perfect protection,—adequate lubrication contributes to this protection, provided the motor is designed to function under the operating conditions.

For high temperature service the lubricant used must be highly resistant to oxidation and formation of gummy, resinous or carbonaceous deposits. In the sleeve-type bearing these would tend to accumulate in the oil grooves to interfere with proper circulation of the lubricant. In a ball or roller bearing they would pack in the raceways or cages to interfere with the rolling of the parts.

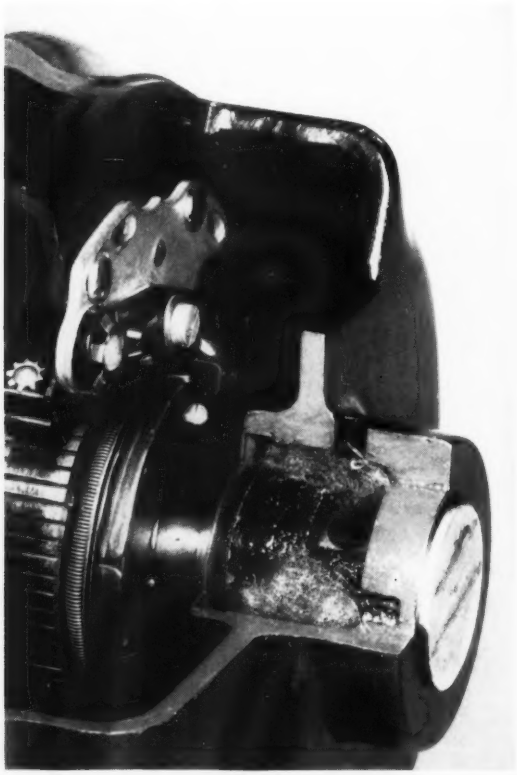
The Gear Motor

The gear motor more recently has made it necessary to consider the possible effect of windage and dust contamination upon the gear lubricant. The gear motor is an especially valuable means of combining the driving and speed reducing elements in one compact housing which is effectively designed to withstand entry of con-

taminating foreign matter. It is advantageous where installation must be made in hazardous or cramped localities, where space is limited or where low driven shaft speeds are required.

Fractional Horse-Power Motors

Household service devices had a lot to do with development of the high-speed fractional horse-power motor. Some of these units are so carefully designed and their bearings are so precise that after initial lubrication they require no renewal of lubricant for indefinite periods. Such motors on all but very high speed vacuum cleaners are sleeve bearing type equipped with waste packing for oil transmission. Fractional horse-power motors on small machine tools and aircraft are generally ball-bearing equipped.



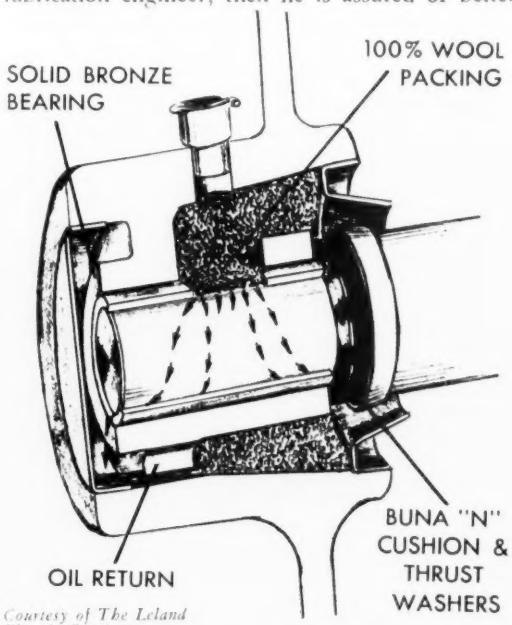
The Petroleum Industry Cooperates

The petroleum industry is particularly interested in trends in motor design and the desire of some motor builders to relieve the operators of all thought of lubrication especially when dealing with ball-bearings. Methods of refinement and compounding are continually developing more dependable greases; products strongly resistant to oxidation, separation and solubility, and free from corrosive alkalis or acids.

It is not justified, however, to place the entire burden on the lubricant. The combination of design, bearings and lubricant can only function under a so-called "life-time" period when the motor is installed under favorable operating conditions. Extremes of temperature, for example, could reduce the dependability of initial "life-time" lubrication and render renewal of lubricant a necessity.

Planning the Installation

Bearings which are adaptable to standard motor design promote easy installation and low-cost maintenance. Where a double shielded or sealed type of bearing may be necessary, if it can be installed with but little trouble, it should benefit all concerned. A proper installation always is appreciated by the lubrication engineer; then he is assured of better performance of his lubricants and relieved of the possibility of explaining failures which so often are due to causes other than faulty lubrication.

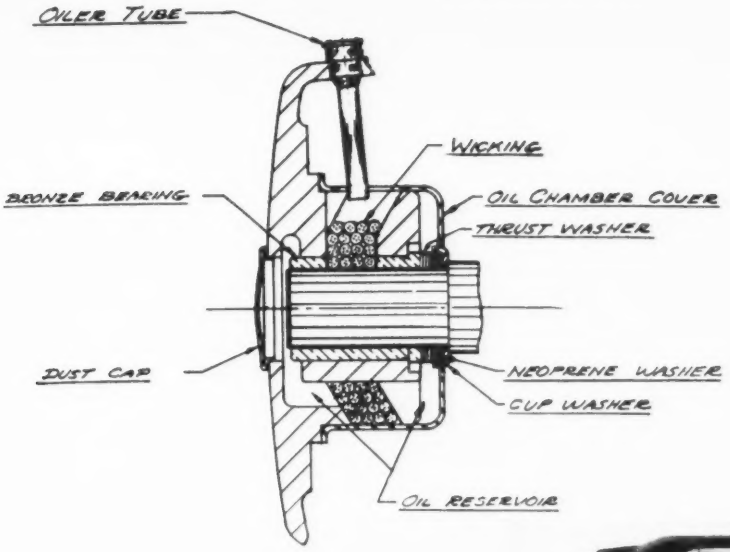


Courtesy of The Leland Electric Company

Figures 1 and 2—Details of a Leland sleeve-type motor bearing. 100% wool wick pressed in the bearing cavity causes oil to rise from the cavity upward by capillary attraction to the window or outlet at the top of the bearing to bring about continuous circulation of oil. Figure 1 at left is cut-away section of a motor which shows the assembly of the bearing.

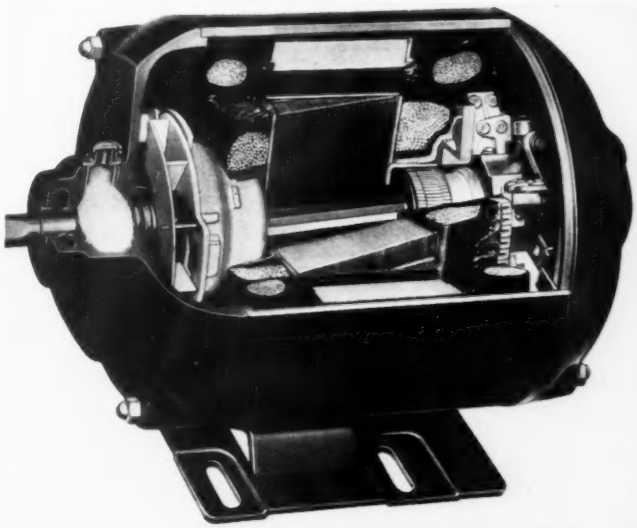
PLAIN OR SLEEVE-TYPE BEARINGS

In the plain or sleeve-type motor bearing, study of lubricant characteristics, composition of bearing metals and methods of lubrication is essential to effective bearing protection. This is assured by positive lubrication through continuous presence of the necessary amount of lubricant to furnish an adequate film, and suitable bearing construction to permit of complete circulation of the lubricant



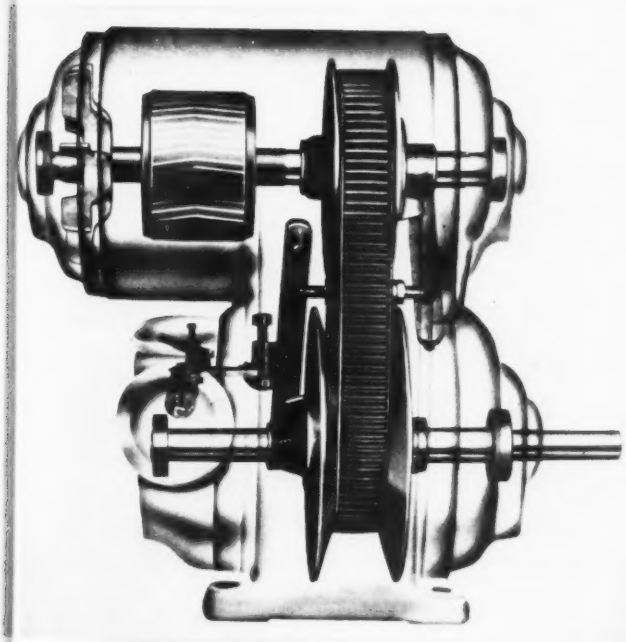
Courtesy of The Brown-Brockmeyer Company

Figure 3—Line sketch of the Brown-Brockmeyer B-Line Sleeve bearing design.



Courtesy of Century Electric Company

Figure 4—Cross-section of a Century ½ horsepower motor designed for wool yarn lubrication. This assures of a continuous flow of filtered oil to the bearings, also prevention of entry of foreign matter.



Courtesy of Sterling Electric Motors, Inc.

Figure 5—The Sterling Speed-Trol electric power drive. Positive lubrication is a feature by virtue of the specially designed seals which prevent entry of non-lubricating materials into the bearing housings.

Courtesy of Allis-Chalmers Manufacturing Co.

Figure 6—View showing upper half of an A-C capsule type sleeve bearing with parts indicated. Pressure equalizing vent pipes on the inner housing oil guard are a feature on A-C high speed motors.

throughout the clearance space which exists between the stationary and moving parts.

The theory of lubrication is based upon a definite relation between load, operating speed, bearing clearance, viscosity of the lubricant and point of oil application. When lubrication is effective and an adequate film is constantly maintained the bearing serves chiefly as a guide to insure alignment; in the event of failure of the lubricating film, however, the bearing must function as a safeguard to prevent actual damage to shafting or other parts of the machine. For this reason, sleeve-type bearing metal must be softer than any of the steels used for shafting or journal construction, and capable of wiping or even melting when in actual rubbing contact with the latter, to insure against scoring or cutting. It must be of sufficient hardness to carry the prevailing loads even at abnormally high temperatures, without wiping or becoming distorted, and yet the metal must be sufficiently plastic or ductile to conform to any irregularities on the surface of the shaft.

Two-part or split bearings are used in some types of heavy duty industrial motors. With this type of bearing the armature can be removed readily without disturbing the bearing assembly or the bearing can be removed without displacing the armature. Lower horse-power or fractional motors which employ sleeve-type bearings, however, are equipped with solid bronze or babbitt-lined shells.

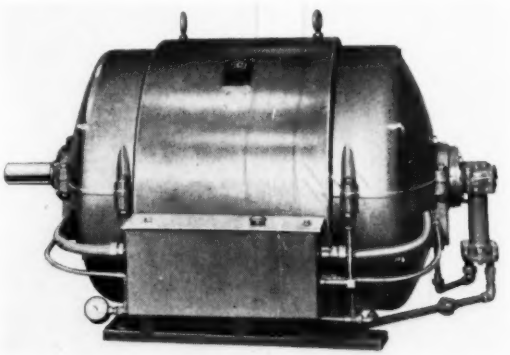
Sleeve-type bearings designed for ring, wick or wool yarn oiling are most dependable when the motor is set horizontally on a level base. In wick oiling systems the wick touches the journal through a hole in the bottom of the bearing. Here flow of oil is upward by capillary action. Wool yarn systems lubricate by the same principle, but here a greater amount of material is used, oftentimes the yarn being in contact with the shaft over a considerable area and completely filling the bearing cavity.

Sleeve-bearings should be designed so as to provide adequate circulation of the oil, which is usually a straight mineral, highly refined product, of viscosity or body suited to the operating conditions.

Normally oils ranging from 150 to 500 seconds Saybolt Universal at 100° F. will function effectually although products of considerably lower viscosity may be used for some types of specialty motors. Stated in absolute units directly related to bearing design, these viscosities are in the range of 30 to 110 centipoises.

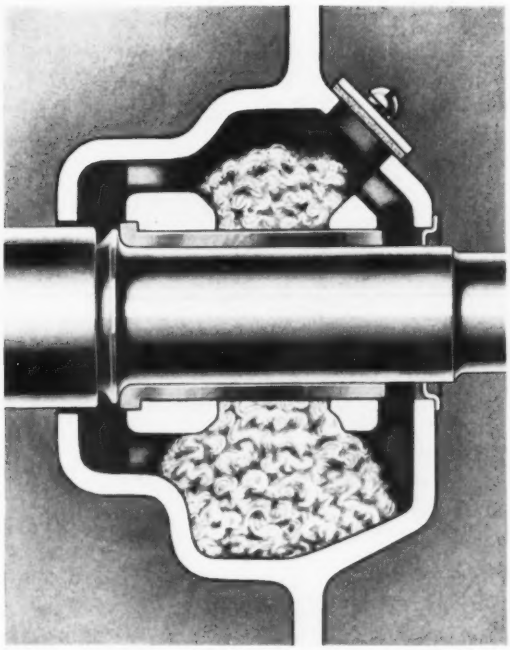
Oil Grooving

Electric motor builders are very careful in the



Courtesy of Electric Machinery Mfg. Co.

Figure 7—A 500 H.P. 2 pole, squirrel cage induction motor designed for pressure lubrication. Oil rings are provided to insure lubrication in case of pressure failure.



Courtesy of Fairbanks-Morse and Company

Figure 8—Showing a Fairbanks-Morse motor sleeve bearing in cut-away. Note use of oil soaked wool waste packing which surrounds the "Oilite" sleeve but does not come in contact with the shaft.

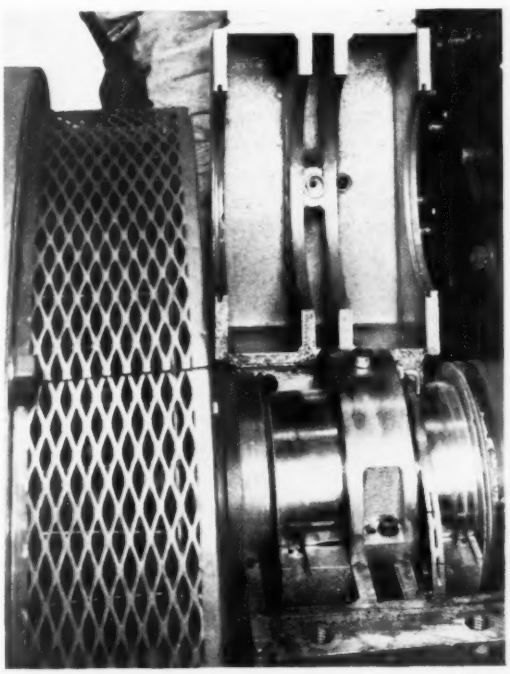
location of oil grooves, and cutting away of the bearing metal. The theory, of course, is to direct the oil to the high pressure area; and promote the necessary pumping action when the rotor shaft is turning. The oil ring or chain, or the wick element delivers oil to the top of the shaft. This starts the circulation of a film through the bearing clearance; wedge action, plus pumping via the oil grooves completes the cycle.

Oil grooves cut in the low pressure surfaces of a bearing help to maintain a protective film at the high pressure area, provided the means of initial delivery of oil are adapted to the constructional and operating conditions and the grooves are connected or located with respect to each other and the point of maximum bearing pressure so that they provide for not only complete and ready distribution of lubricant throughout the bearing clearance space, but also a way for collection and subsequent flushing out of any abrasive foreign matter which might gain entry to impair lubrication.

How oil grooves function in service will be of interest. Normally, they provide an initial receptacle for receiving the oil as it passes into the bearing from the lubricator, thus serving as a means for distributing lubrication lengthwise along the bearing so that as the moving surface of the rotating or sliding element passes the grooves or chamfers, it will take up an adequate protective film of lubricant. In theory, this is thick film lubrication.

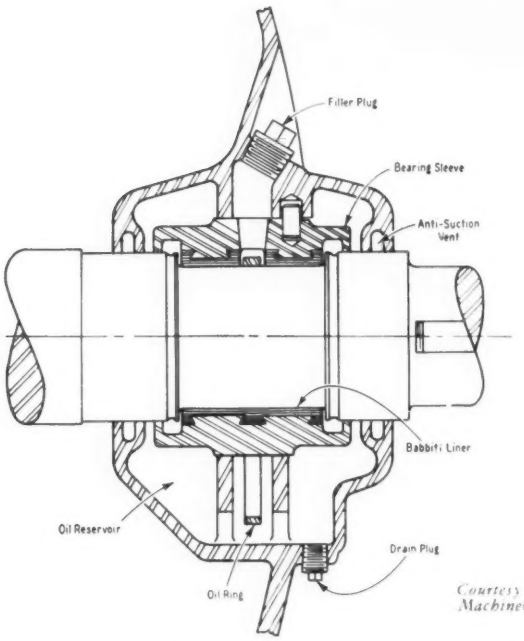
By suitably designing a system of grooving provision can be made for circulation of oil alternately from the center of the bearing to the outer ends and back again. How intricate such a layout would have to be would depend primarily upon the means of initial lubrication. Where sight feed or drip lubrication is involved, or in other words periodic lubrication with just about the right amount of oil to maintain an adequate lubricating film, grooving will play a more important part than where flood lubrication is employed. Well designed grooving also prevents excessive oil leakage at the ends of the bearings.

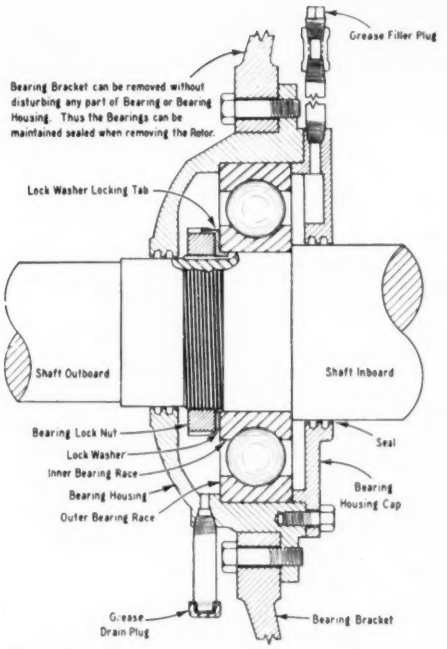
Grooving should be confined to those parts of the bearing which carry the least load. Oil must flow from a low pressure area to a zone of higher pressure. Should this latter be grooved to any extent there may be the possibility of oil being carried from the bearing, the lubricating film impaired, waste increased, and the development of abnormal wear. In a two-part motor bearing only the top bearing normally is grooved. No sleeve bearing should be cut away or have the continuity of its surface altered by grooves within fifteen degrees either way of the point of maximum pressure.



Courtesy of The Electric Products Company

Figure 9—One-to-one type motor bearing designed by Electric Products with ratio of length to shaft diameter 1:1. Another feature of this design is the elimination of oil grooves.





Courtesy of Electric Machinery Mfg. Co.

Figures 10 and 11—Cross-sectional features of Electric Machinery sleeve-type and ball bearing motor bearing assemblies. Salient parts are indicated.

otherwise uniformity in the oil film may be impaired. Furthermore, the lubricant should wherever possible be led into the bearing at the point where pressure is lowest so that the wedge action set up by chamfering will aid in film formation.

The ring-oiled sleeve bearing utilizes its oil grooves and the passages at each end of the bearing to return the oil to the reservoir in the base; at the same time this return oil will flush out any non-lubricating material before windage can draw it through the bearing.

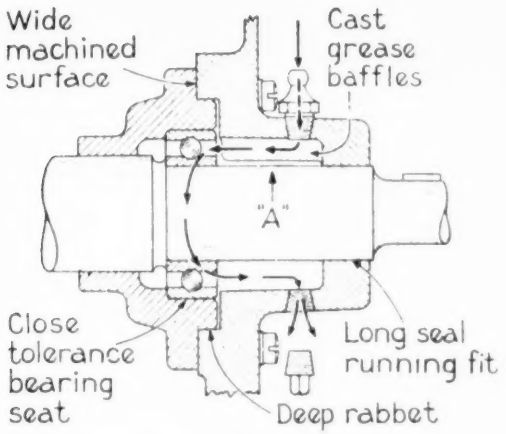
Lubrication Procedure

The limited quantity of oil in a sleeve-type motor bearing and the rapid rate of circulation requires careful consideration of both the quality and the probable operating viscosity. As this latter is influenced by temperature, the operating range should be ascertained and the viscosity of the lubricating oil decided upon accordingly. Not much cooling occurs other than by radiation of heat from the exterior of the bearing or its oil reservoir. Yet, even this comparatively small area normally keeps bearing temperatures well below the danger point, and usually comfortable to touch. The oil reservoir in the modern ring-oiled motor bearing also will be of adequate capacity to give the oil some time to rest and settle out any sediment or foreign matter that may have been picked up through windage or penetration. This occurs more rapidly with lighter oils.

Settling and radiation become more effective when the level is not carried too high. This is why renewal of lubrication is important. Provided there is an oil filler and gauge installed (to control the oil level) it will be more cleanly and economical to add oil at this point while the motor is idle, to about one-eighth of an inch from the top, instead of filling through the inspection port at the top. The latter procedure often leads to waste through over-flow.

Too much oil can cause oil creepage into the motor. This may be accelerated by windage along with the development of oil spray where the oil level is carried too high, or if the oil overflow is not large enough. Oil which is carried to the top of a ring-oiled bearing must be taken care of and returned to the reservoir as rapidly as it is delivered by the ring. Otherwise, as stated, oil may accumulate in the upper part of the housing ultimately to be forced into the interior of the motor. This is detrimental to the coils, for oil-soaked insulation becomes a fire hazard and often requires a repair or maintenance job.

To prevent this and also to protect the armature coils and pole windings, motor builders install oil baffles, throwers or labyrinth packing on the motor or inboard side of the bearing and oil filler plugs on the side of the bearing housing. Such devices in particular prevent direct circulation of air from the outside and through the bearings. In company with proper grooving of the bearing metal to permit ready distribution and return of the oil, they are regarded as adequate assurance that effective lubri-



Courtesy of General Electric Company

Figure 12—Showing path of grease in a G-E Tri-Clad induction motor.

cation will be maintained.

A sealed vapor and spray chamber at each end of the bearing also will function to retain oil vapor and spray which may be thrown off by the oil rings. Provision to return this oil to the reservoir in the base of the bearing is of particular advantage in maintaining economy and cleanliness.

Any lubricant present elsewhere than in the lubricating system may very easily develop a hazardous or sloppy condition which should be corrected as soon as possible. Attention to bearing design and adoption of sealing devices which will positively keep the lubricant where it belongs and prevent entry of foreign matter assures of dependable operation.

BALL AND ROLLER BEARINGS

The use of ball bearings imposed an added responsibility upon the bearing manufacturers, as it required improvement of bearing seals, not only to extend the life of the quality lubricants which were necessary for lubrication, but also the prevention of entry of contaminating foreign matter. Effective sealing also reduces windage.

Low power consumption likewise became a factor in the development of bearings for the fractional horse-power motor, as this was proved to be a function of lubrication. Grease research was concentrated upon the study of ball and roller bearing greases of low torque characteristics, likewise maximum stability. Grease is often favored in that it is more easily retained by some bearings than oil.

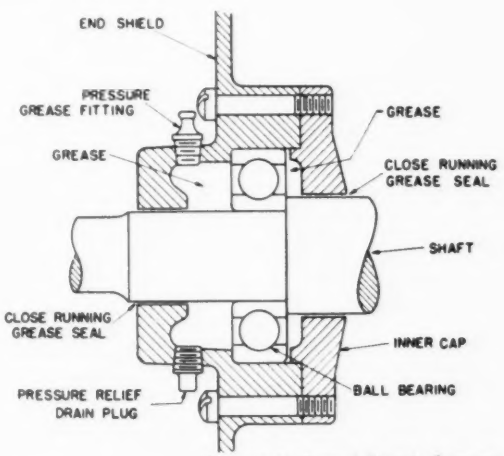
The duty of the lubricant in a ball or roller bearing is extended beyond actual lubrication. The ability to prevent actual metallic friction must be supplemented by the protective ability, whereby the lubricating film is such that corrosion is prevented, even under a wide variation in atmospheric conditions. The oil industry provides for this by adding carefully selected anti-oxidants to greases for such service.

Actual contact between metallic bearing surfaces of the balls or rollers and their cages or retainers is the principal cause of wear due to development of metallic or solid friction. Rolling motion is essentially involved, meaning that in a properly designed bearing which has not been subjected to abnormal wear, the possibility of sliding contact will be relatively negligible. A lubricating film of suitable thickness and body to keep the metallic surfaces apart under the prevailing speed and pressure enables fluid friction to supplant solid friction. Grease functions like thick-film oil lubrication in this regard.

Sealed Bearings

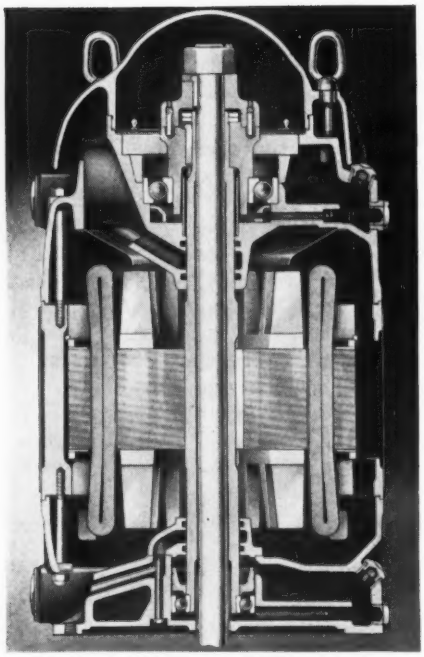
The sealed-type of prelubricated ball bearing is being widely used in motor service today where speed control and low power consumption are of chief importance. This includes household equipment, such as vacuum cleaners, also small high speed machine tools, some types of textile machinery and industrial type motors up to around 200 horsepower. The relation of the type of lubricant to speed is often overlooked. Where speed must be accurately controlled in precision equipment, low starting and running torques are most essential.

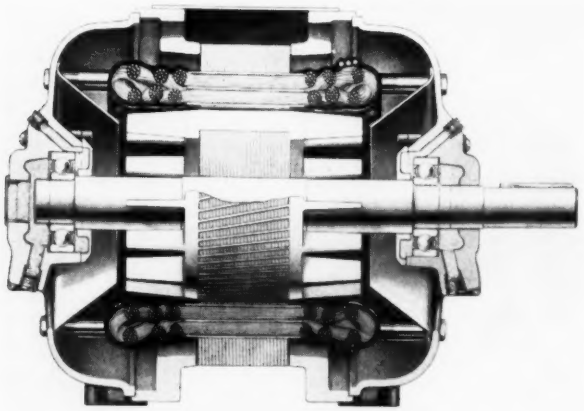
The service has an influence upon the type of seal used. The purpose of the seal is to prevent leakage of lubricant or entry of contaminating foreign matter. A variety of seals have been developed including felt and cork washers or gaskets, metallic slingers, dust collars, expanding leather devices, grease-filled grooves, or various combinations of these.



Courtesy of General Electric Company

Figure 13—The G-E Tri-Clad completely enclosed motor bearing housing showing relation of parts.





Courtesy of U. S. Electrical Motors Inc.

Figures 14 and 15—Details of U. S. Verticlosed Motor (left) and U. S. Uniclosed Motor (above).

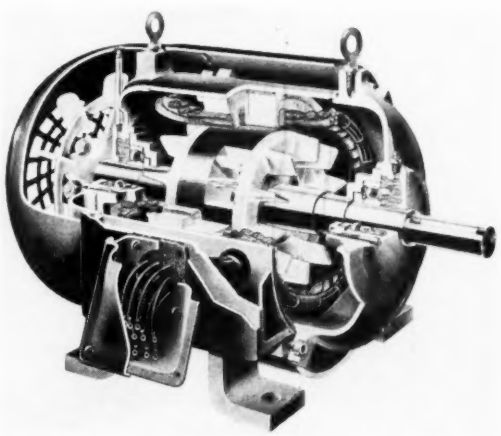
Ball or roller bearings in motor service being lubricated most generally by grease, and devoid of lubricant circulation beyond the bearing, must be serviced as units.

Type of Grease

Grease for motor ball bearing lubrication should be as free from acid-forming tendencies as possible in order to insure adequate protection of the highly polished metallic surfaces. In effect, this involves manufacture of an essentially neutral product and, of course, the absence of fillers. The presence of any material that might give rise to oxidation and corrosive reaction, or to decomposition or settling is also objectionable. Such a grease should contain a highly refined oily constituent having high resistance to oxidation. This oil should be combined with carefully selected, high-grade soaps. Inhibitors usually are added to further improve the resistance to oxidation. Mechanically the grease should be easy to apply, have low starting and running torques, be adhesive (not throw off), withstand heat, be highly stable and resistant to leakage. When very high temperature service is involved up to around 350°F. the grease should be specially prepared to function under heat conditions.

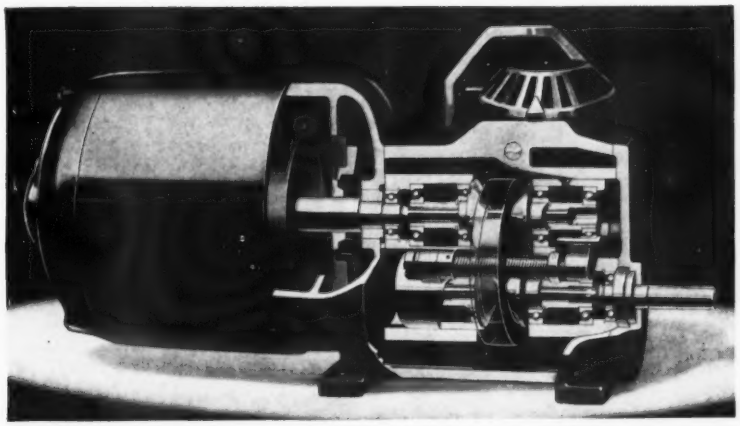
Normally a grease lubricated ball bearing should not be filled more than half full. This means the pressure guns should be carefully handled for at best the amount can only be estimated, unless the bearing is hand packed. Too much grease can cause over-heating and leakage past the seals.

The trend in motor design is more and more to build a unit which will be immune to external conditions. The modern explosion-proof motor is typical. Here, not only the bearings but also the windings are insured against entry of any type of foreign matter. Any leakage of lubricant in such a unit would obviously be to the detriment of not only the bearings but also the adjacent motor parts. In this development high temperatures also had to be considered, especially for motors designed for steel mill, stoker, and economizer service and textile finishing. The effect of high temperature on certain sealing materials involves deterioration. The effect of high temperature on lubrication is to reduce the viscosity or consistency of any lubricant. The extent to which this will occur depends, of course, upon the original body of the product.



Courtesy of The Reliance Electric & Engineering Co.

Figure 16—Cut-away view of a Reliance totally-enclosed fan-cooled induction motor.



Courtesy of The Master Electric Company

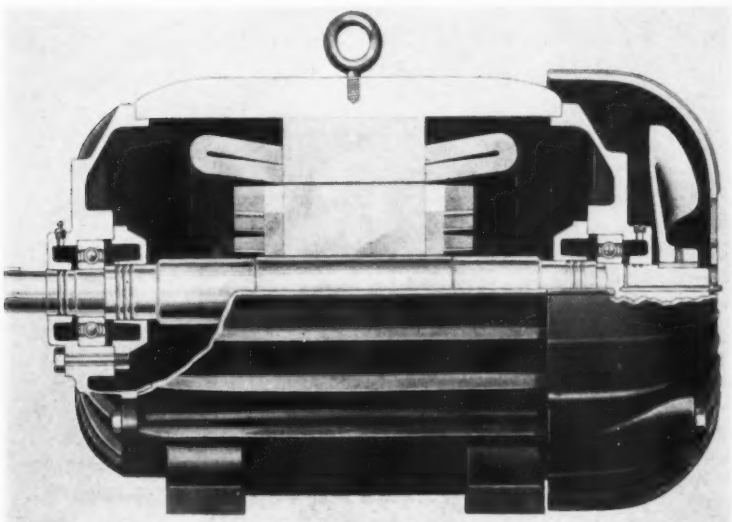
Figure 17—The Master Speed ranger showing ball bearing locations.

Unless the latter is of the nature of a steam cylinder oil and possessed of adequate viscosity, at steel mill temperatures considerable leakage may result from certain types of bearings. For this reason, steam cylinder stocks are used in certain grades of high temperature ball and roller bearing greases. A lubricant of this nature, along with a suitable bearing seal, will keep down leakage to a marked degree even under very high temperatures.

Vertical motor installations have called for considerable study of sealing devices. The ball bearing has proved to be particularly adaptable to such motors, due to its dependability under high speeds and intensive thrust loads. When such motors are

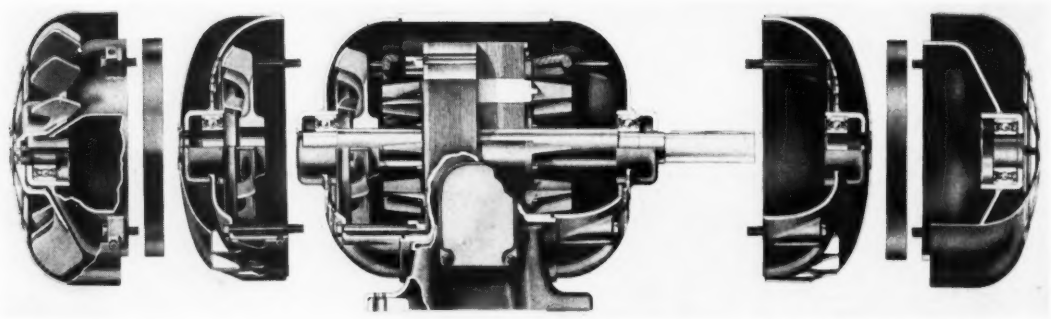
Courtesy of The Brown-Brockmeyer Company

Figure 18—Cut-away view of a Brown-Brockmeyer brush riding repulsion induction motor equipped with ball bearings of the pre-lubricated sealed type.



Courtesy of Crocker-Wheeler Electric Mfg. Co.—Div. of Joshua Hendy Corp.

Figure 19—Details of a Crocker-Wheeler Sealed-Power ball bearing motor.



Courtesy of Westinghouse Electric Corporation

Figure 20—Exploded view of the Westinghouse Life-Line motor showing bearing hub and ball bearing assembly.

designed for oil lubrication, cups are connected through ducts to the bearings housings. The oil level in the system should be kept well up to assure of thorough lubrication. This is a phase of splash oiling.

Seal Wear Must Be Low

A bearing seal must not only seal, but also it must show practically no wear in service, otherwise, the purpose may be more or less defeated. Washer type seals may consequently be unsatisfactory, although the rate of wear will depend upon the quality of the material. Adjusting springs can be used in connection with washer or leather cup seals in order to keep the material in close contact with the shaft or journal surface. This will compensate for wear and enable the bearing to retain its lubricant more dependably.

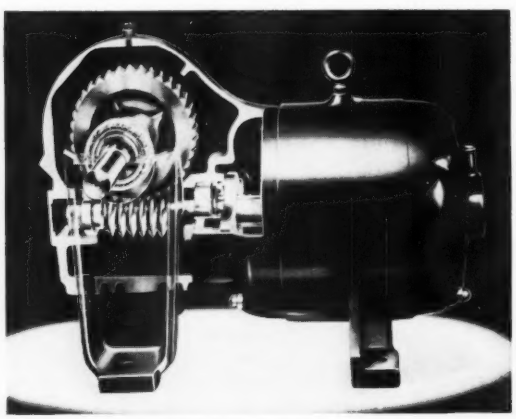
Grease Groove Seals

Grease groove seals are used to prevent leakage of lighter lubricants. They are also relatively simple and inexpensive to design. They must be periodically examined, however, in case the sealing grease requires renewal. Otherwise possible glazing of the surface of this latter where it comes in contact with the rotating shaft might result in sufficient clearance to allow leakage of the bearing lubricant.

Very heavy bodied greases of high melting point are adaptable to service as grease seals, provided they show no tendency to separate oil from soap, and contain no material which might be abrasive to the shaft surface. Grease grooves can also be used together with felt washers in certain types of service, although this may require extension of the length of the bearing housing.

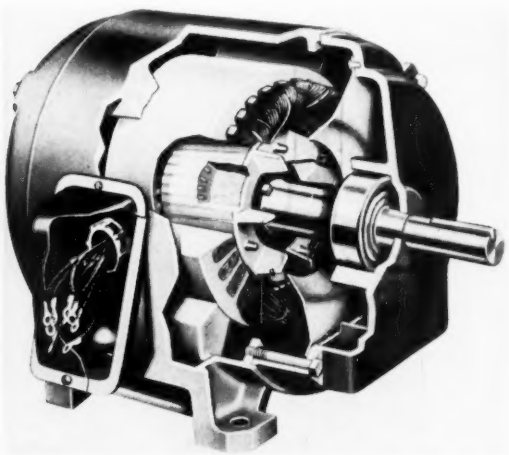
Relation of Lubrication to Insulation

In any piece of electric power generating or transmission machinery, the insulation must be in good condition if the machine is to operate properly. Lubrication, especially over-lubrication, can affect motor life because it can cause oil-soaked insulation. Oil travel along the shaft from an over



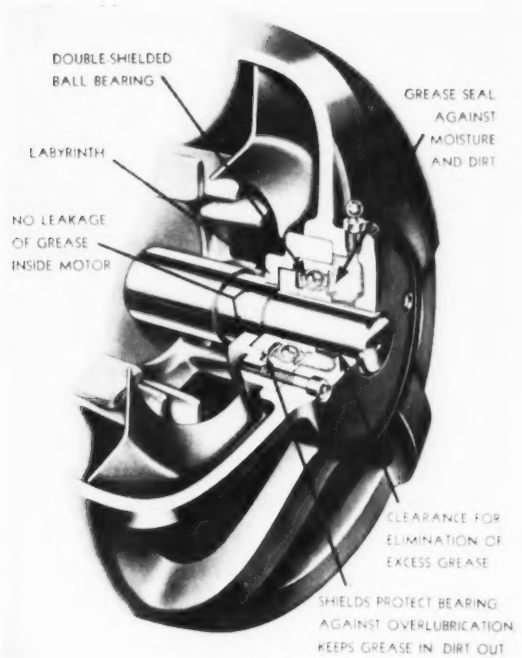
Courtesy of The Master Electric Company

Figure 21—In the Master right angle gearhead motor all gears and bearings are lubricated by the oil in the gear-case. Splash provides adequate lubrication for the bearings.



Courtesy of Allis-Chalmers Manufacturing Company

Figure 22—Details of the Allis-Chalmers splash-proof motor.



Courtesy of The Reliance Electric & Engr. Co.

Figure 23—Details of a Reliance Precision-Built Motor. The bearing housing provides a large reservoir of grease which automatically replenishes lubricant inside the bearing over long periods of operation.

lubricated bearing also may carry dirt or dust accumulations to the windings. All this can result in higher operating temperatures. Too much heat and the softening solvent effect causes oil soaked windings to deteriorate rapidly.

This is fully realized by motor builders and operators in industries where high running temperatures and dirt must be considered. They counteract the effect by using double shielded or sealed bearings, following a regular and carefully controlled relubrication procedure, and enclosing motor drives in pressurized rooms when practicable.

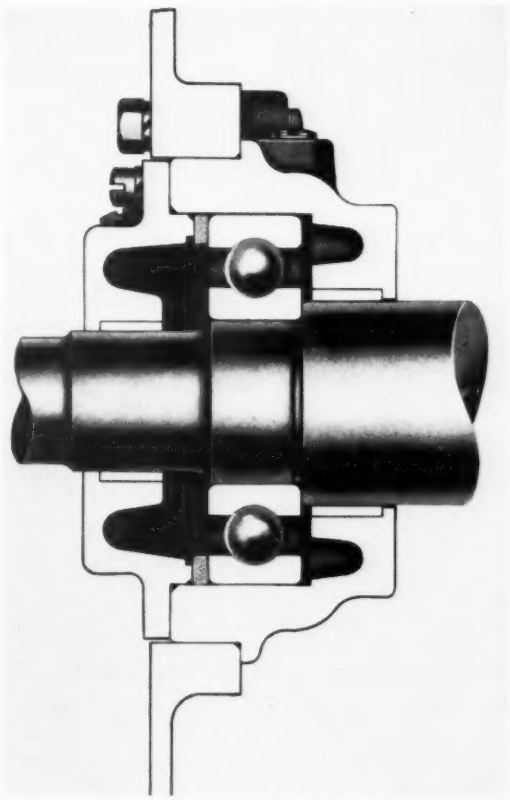
CLEANING AND FLUSHING

Cleaning and flushing is an important procedure in motor bearing maintenance. The frequency of such a procedure will be governed by the type of bearing and the conditions to which it is exposed. Ring or chain oilers on sleeve-type bearings automatically flush themselves to settle any foreign matter in the reservoir below the bearing. Wick oilers or other methods of periodic lubrication are not so effective; here, if foreign matter can get in, it stays there until the bearing assembly is flushed and cleaned. The same holds true for the grease-lubricated ball or roller bearing.

It is especially important to keep abrasive contaminants out of ball or roller bearing greases as churning of abrasive foreign matter with the grease, between moving parts, which are precision-built to clearances of only a few ten-thousands of an inch, will cause serious damage to the bearing elements. For this reason, specialty greases for ball and roller bearings are prepared from carefully selected and filtered ingredients, and even later filtered by some ball bearing manufacturers, if they are to be used in pre-lubricated, sealed-type precision bearings. In service, the seal should be so effective as to keep such lubricants in this high state of purity.

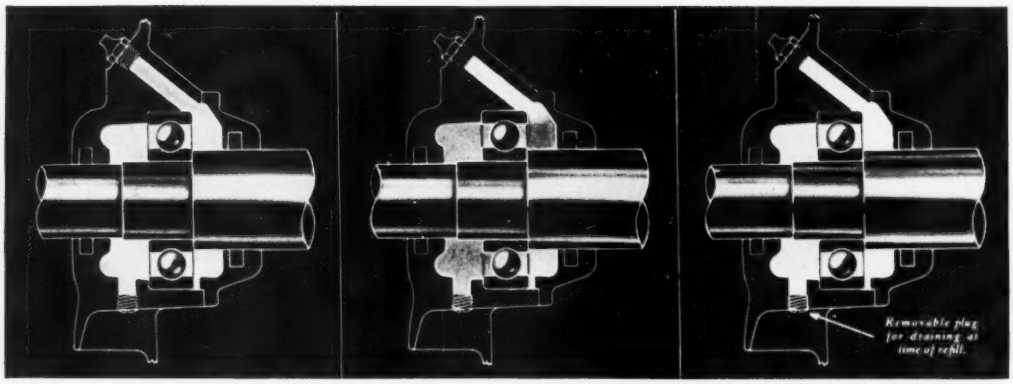
To set any hard and fast rule, even with the best of seals, is unwise, however, due to the wide variety of service to which motors must be subjected, particularly in industrial or power plants. The extent to which dust, dirt, metallic chips or scale may be present in the air or be drawn into any bearing will, of course, be an influencing factor.

Oil-lubricated bearings can be drained if an outlet is located in the base or lower part which can be tightly plugged in service; this will prevent leakage during operation. Sometimes this can be elaborated upon by an arrangement of nipples and



Courtesy of Fairbanks-Morse & Company

Figure 24—The F-M ball bearing Motor assembly, adaptable to open as well as splash-proof motors. Effective sealing is a feature.



Courtesy of U. S. Electrical Motors Inc.

Figure 25—Features of U. S. Lubriflush lubrication.

Left — Bearings in Lubriflush bearing chambers are packed with fresh lubricant when shipped from the factory.

Center — After some months' service, all the old devitalized lubricant should be replaced.

Right — New lubricant is injected on the right hand side of the bearing and is forced through the bearing and out the drain on the left hand side of the bearing, completely flushing the bearing and bearing chamber.

pipe fittings terminating in a sight gage glass. This facilitates not only cleaning, but also observation of the oil level in the bearing. Oil lubricated sleeve-type bearings should be gaged regularly for oil level in reservoirs, and only enough oil should be added to bring the level to the proper height.

Cleaning Procedure

Sleeve-type motor bearings will often require more frequent cleaning than ball or roller bearings, as their housings cannot always be so tightly built. With the former, cleaning may be necessary or advisable at periods ranging from every two weeks to every several months according to the extent of dust or dirt in the surroundings; whereas a properly housed ball or roller bearing may function much longer under the same conditions. On the other hand, such bearings are more delicate from the viewpoint of construction, and therefore, the lubricant should not be allowed to become so contaminated as to cause abrasion, rough running and noise.

Wherever grease lubricated ball or roller bearings are involved and drainage cannot be readily carried out, due perhaps to the body or consistency of the lubricant, the grease should be wiped out thoroughly at the period of cleaning. It is also practicable to flush some types of ball and roller bearings with hot oil. Such bearings can be all the more completely cleared of used grease if the drain plug is removed when new grease is applied, as it is when flushing.

Ring-oiling systems possess natural advantages in that the flood of oil which is constantly passing through the bearings tends to wash out any grit, dirt, dust or metallic particles that may have gained entry. As a result, wear is reduced to a minimum, just as long as the oil in the system does not become so highly contaminated as to be unable to precipitate such foreign matter during its period of so-called rest. The washing action in a flood lubricated bearing naturally causes gradual accumulation of foreign matter, therefore, the condition of the oil should be carefully watched, and the system drained when any excess of dirt becomes apparent.

A flushing oil wash (using an automotive type of crankcase flushing oil heated to around 140° F.) will normally take up and remove such material. In an installation which has been subjected to severe service, neglected or filled with an unsuitable gum-forming lubricating oil, a petroleum solvent may be required.

CONCLUSION

A number of factors can affect electric motor operation. They include overloading, extremes of temperature, vibration, dust and dirt, and lubrication. Often, the most aggravating is lubrication because it seems so simple. Only two bearings are involved. Offhand, they seem to be well housed, so a shot of grease from a pressure gun or some oil (if the bearing is built for oil) is all that seems necessary now and then.

"Now and then" is what causes so many motor bearing troubles. Furthermore, so often, it's not the lubricant but the way it is applied. Too little can lead to bearing wear through starved lubrication. Too much can cause seal failure or oily windings. A regular schedule for relubrication (after studying the operating conditions along with the bearing design), and a regular schedule for cleaning can go a long way in promoting motor life in line with manufacturers standards. This article is presented with these thoughts in mind.

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